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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>5</sup> :</b> <b>A61G 5/02, B62M 1/14</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 90/07316</b> <b>(43) International Publication Date:</b> 12 July 1990 (12.07.90)
<b>(21) International Application Number:</b> PCT/AU89/00556 <b>(22) International Filing Date:</b> 22 December 1989 (22.12.89) <b>(30) Priority data:</b> PJ 2129 23 December 1988 (23.12.88) AU <b>(71) Applicant (for all designated States except US):</b> AVANTECH PTY. LIMITED [AU/AU]; 6 Mary Parade, Rydalmere, NSW 2116 (AU). <b>(72) Inventors; and</b> <b>(75) Inventors/Applicants (for US only) :</b> MEYER, Dolph, Allan [AU/AU]; 69 Jenkins Road, Carlingford, NSW 2118 (AU). MEYER, Wayne, Allan [AU/AU]; 56 Finlay Road, Turramurra, NSW 2074 (AU). <b>(74) Agent:</b> F.B. RICE & CO.; P.O. Box 117, Balmain, NSW 2041 (AU).		<b>(81) Designated States:</b> AT (European patent), AU, BE (European patent), CH (European patent), DE (European patent), ES (European patent), FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent), US.  <b>Published</b> <i>With international search report.</i>
<b>(54) Title:</b> WHEELCHAIR PROPULSION MEANS  <b>(57) Abstract</b> <p>A wheelchair having a pair of drivable wheels one of which is disposed on each side of a chair portion, a carriage slidably mounted to rotate about the rim of each wheel or another annular member coaxial therewith, a handle on each carriage grippable by a person using the wheelchair and manually actuable means on each carriage adapted to releasably engage the carriage with the annular member. The handles and the means adapted to releasably engage the annular members allow a user's propulsive force to be transmitted more easily and comfortably to the wheels and also allows for more certain braking of the wheelchair.</p>		

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WHEELCHAIR PROPULSION MEANSField of the Invention

The present invention relates to wheelchairs and more particularly to propulsion means to assist in the manual  
5 propulsion of wheelchairs of the type having a pair of driving wheels.

Prior Art

It is conventional for manually propelled wheelchairs to include a front pair of small castor wheels and a rear  
10 pair of driving wheels. The driving wheels are conventionally driven by the user of the wheelchair manually gripping the tyre and rim of the wheels or gripping an annular rib mounted coaxially on the wheel and projecting out of the plane thereof. The wheels of the  
15 wheelchair may be caused to rotate or can be braked by appropriate manual manipulation of the wheels or the annular rib attached thereto. There are a number of problems associated with this arrangement. Firstly when propelling the wheelchair forwardly the user grips the  
20 wheel or rib near the rearmost part of the wheel and continues to grip the wheel or rib and propel the wheelchair forwardly through an arc of at least 90° and usually substantially more. This movement causes considerable strain on the user's wrists which must flex  
25 through a considerable angle as the wheels are rotated. Secondly, it is often difficult to get a firm grip on the wheel or the rib, both when propelling the wheelchair and when braking it, as it is often not possible for a user's grip to completely surround the full cross-section of the  
30 wheel tyre and rim or the rib due to the presence respectively of wheel spokes and arms holding the rib to the wheel. The users hands are also used to grip the wheel or the rib to brake the wheelchair. This can cause abrasion of the skin and is generally stressful.

35 Disclosure of the Invention

The present invention consists in a wheelchair having a pair of drivable wheels one of which disposed on each side of a chair portion, a carriage slidably mounted to rotate about the rim of each wheel or on another annular member coaxial therewith, a handle on each carriage grippable by a person using the wheelchair and manually actuatable engagement means on each carriage adapted to releasably engage the carriage with the annular member.

In another aspect the present invention consists in a wheel for a wheelchair having slidably mounted on the rim of the wheel, or on another member coaxial therewith, a carriage, a handle being provided on the carriage and being adapted to be grippable by a person using a wheelchair on which the wheel is mounted, and manually actuatable engagement means on the carriage adapted to releasably engage the carriage with the annular member.

The driveable wheels of wheelchairs are generally spoked with an inflatable tyre. They can alternatively be molded from plastic and may be solid tyred. The present invention is applicable to any of these conventional driveable wheelchair wheels. The carriage may be provided directly on the rim and/or tyre of the wheel or disposed on a rib which is coaxial with the wheel but lies in an adjacent plane. The carriage is preferably provided with a plurality of rollers adapted to bear against the annular member such that the carriage will slide freely around the rim/tyre or rib of the wheel.

In a preferred embodiment of the invention the carriage includes an elongate arm pivotally connected to the axle of the wheel to which it is affirmed, or to a member coaxial therewith. The arm preferably has on its end distal to the axle of the wheel a plurality of rollers adapted to engage with an annular member mounted on the wheel. The handle is preferably pivotably mounted on the end of the arm distal to the axle and carries on it

engagement pads adapted to be brought into engagement with the annular member by pivotal movement of the handle relative to the arm. The arm may extend beyond the axle and be provided with a counterweight such that the carriage, and the handle, will be biased into a position in which the handle may be readily grasped by a user.

A handle is provided on each carriage which is manually grippable by a person using the wheelchair. Each handle preferably includes a substantially cylindrical portion which may be gripped by a hand of the user. This substantially cylindrical portion is preferably mounted on the carriage in such a way that it may be pivoted about an axis normal to its own axis. This allows the users hand and wrist to maintain substantially the same orientation to the handle throughout a propulsion stroke.

The carriage is also provided with manually actuable engagement means to releasably grip the annular member whether it be the tyre and/or rim of the wheel or an annular rib connected to the wheel. The engagement means allows the carriage to be engaged with the wheel such that a propulsive force can be transmitted from the handle to the wheel and so that a braking force may be applied to the wheel.

The engagement means preferably comprises a pad engageable with the annular member and actuating means on the handle to cause the pad to be brought into or out of engagement with the annular member. The actuating means may comprise a lever on the handle which is depressed to cause a camming action moving the pad. Alternatively, the handle itself may be moved relative to the carriage to cause movement of the pad. If desired the pad may bear against a side or arc of the annular member or it may engage about the whole cross-section perimeter of the annular member.

In a particularly preferred embodiment the engagement

means engage with an annular groove in the annular member, the groove having a pair of annular surfaces, each flat in cross section, which converge in a direction away from the engagement means. The engagement means in this embodiment  
5 of the invention includes a pair of engagement pads each having a pair of converging engagement surfaces. Each of the engagement pads is connected to the handle through an engagement pad support member pivotably connected to the engagement pad and to the handle, the pivotal connections  
10 being about axes radial to the annular member. This arrangement has the advantage that upon the actuation of the engagement means one or other of the engagement pads, depending upon the direction of rotation of the wheel, will be driven into the groove in the annular member by  
15 the pivotal action of the brake pads and the support member about the arm.

#### Brief Description of the Drawings

Hereinafter given by way of example only is a preferred embodiment of the present invention described  
20 with reference to the accompanying drawings in which:-

Fig. 1 is a diagrammatic side elevational view of a wheelchair according to the present invention showing the handle in three positions on the wheel during a propulsive forward stroke of a user of the wheelchair;

25 Fig. 2 is a side elevational view of a carriage, handle and engagement means of the wheelchair of Fig. 1;

Fig. 3 is a cross-sectional view along III-III of Fig. 2;

30 Fig. 4 is a cross-sectional view along IV-IV of Fig. 2;

Fig. 5 is a side elevational view of a wheel, a carriage, a handle and an engagement means according to another embodiment of the invention;

Fig. 6 is a section along A-A of Fig. 5;

35 Figs. 7(a) and (b) are respectively detailed vertical

sectional views through the handle and the upper end of the carriage of Fig. 5 in an unbraked and a braked condition; and

5 Figs. 8(a) and (b) are respectively sectional views along B-B of Fig. 7(a) and C-C of Fig. 7(b).

Best Mode for Carrying out the Invention

The wheelchair 10 has a seat portion 11, a pair of front castor wheels 12, and a pair of rear driving wheels 13. As is best seen in Figs. 2 and 3, each  
10 wheel 13 has a laterally displaced and coaxial rib 14 connected to the rim 15 of the wheel 13 by arms 16. The rib 14 is of square cross-section and has mounted on it a C-shaped carriage 17. The carriage is formed with four transverse rollers 18 which bear against the upper and  
15 lower surfaces of the rib 14. An arm 19 is pivotably mounted on the carriage 17 intermediate the ends thereof. The arm 19 curves inwardly towards the rim 15 from the carriage 17 and is pivotably connected at its free end to a handle 21.

20 The handle 21 comprises a stirrup 22 and a cylindrical portion 23 interconnecting the ends of the stirrup 22. The pivotal connection between the stirrup 22 and the arm 19 is such that the handle 21 can pivot about an axis normal to the axis of the cylindrical portion 23.

25 Adjacent the pivotal connection between the arm 19 and the carriage 17 the arm 19 carries an engagement pad 24. The pad 24 is pivotably connected to the arm 19 and includes a face adapted to be brought into bearing engagement against one face of the rib 14.

30 In use a user sits in the chair portion 11 of the wheelchair 10 and grips the cylindrical portions 23 of the respective handles 21. By firstly moving the handles 21 relatively inwardly the arms 19 are caused to pivot downwardly and thus cause the pads 24 to be forced into  
35 engagement with ribs 14. Rotary motion of the handles 21



about the axes of the wheels 13 will then propel the wheelchair 10 either forwardly or backwardly depending upon the direction of rotation of the wheels 13.

Braking of the wheelchair 10 may be effected when the  
5 wheelchair 10 is moving by again moving handles 21 relatively together. If desired stops (not shown) may be provided to limit forward travel of the carriage 17 about the wheels 13, thus if a user lets go of a handle the carriage 17 will only slide forward around the wheel until  
10 it meets the stop. The stop is preferably disposed just ahead of the end of a normal forward propulsion stroke for the user.

As can be seen in Fig 1 the handle 23 may be pivoted relative to the carriage 17 throughout each propulsive  
15 stroke to maintain the handle substantially perpendicular to a users arm throughout at all times.

A second embodiment of the invention is described with reference to Figs. 5, 6, 7(a), 7(b), 8(a) and 8(b). Many of the components of this embodiment are similar to  
20 those of the embodiment of the invention described with reference to Figs. 1 to 4 and similar numeric designations will be used for similar components.

The wheelchair wheel 13 has four arms 16 connecting about its hub 30. The arms 16 support an annular  
25 plate 31. The annular plate 31 is formed with an annular groove 32 having a pair of annular side walls 33 and 34 which are substantially planar, and which converge towards the base of the groove 32, when seen in cross-section.

The carriage 17 includes an elongate arm 35 which is  
30 pivotally mounted on its end distal to the handle 21 on a boss 36 mounted on the wheel 13 and coaxial with it. The carriage includes at its other end a pair of rollers 18 adapted to bear against opposite sides of the annular plate 31.

35 The handle 21 is pivotably connected by pivot pin 40

to the end of the carriage 17 distal to the axis of the wheel 13 and carries engagement pads 24. Inwards movement of the handle 21 moves engagement pads 24 into engagement with the groove 32 in the annular plate 31. Each of the engagement pads 24 has a pair of convergent faces 37 and 38. Each of the engagement pads is pivotably connected to a triangular engagement pad support plate 39 by a pivot pin 41 extending substantially radially of the wheel 13. Each support plate 39 is also pivotally connected to the carriage 17 by a radially directed pivot pin 41. The two adjacent support plates 39 on each carriage 17 are also pivotally connected to the handle 21. The support plate 39 only loosely surrounds the pivot pins 41 so that movement of the handle 21 towards the wheel in the direction of arrow X of Fig. 8b will cause the respective engagement pads 24 to move in an arcuate path away from one another and towards the wheel as indicated by arrows Y of Fig. 8b. The movement of the wheel either forward or rearward when engagement of the engagement pads 24 with the annular plate 31 is for the purpose of braking or movement of the carriage either forwards or rearwards when the engagement is for the purpose of propulsion will cause one or other of the engagement pads 24 to be urged into tight frictional engagement with groove 32 in the annular plate 31.

It will be recognised by persons skilled in the art that numerous variations and modifications may be made to the invention as described above without departing from the spirit or scope of the invention as broadly described.

## CLAIMS:-

1. A wheelchair having a pair of drivable wheels one of which disposed on each side of a chair portion, a carriage slidably mounted to rotate about the rim of each wheel or on another annular member coaxial therewith, a handle on each carriage grippable by a person using the wheelchair and manually actuatable engagement means on each carriage adapted to releasably engage the carriage with the annular member.
2. A wheel for a wheelchair having slidably mounted on the rim of the wheel, or on another member coaxial therewith, a carriage, a handle being provided on the carriage and being adapted to be grippable by a person using a wheelchair on which the wheel is mounted, and manually actuatable engagement means on the carriage adapted to releasably engage the carriage with the annular member.
3. A wheelchair as claimed in claim 1 or a wheel for a wheelchair as claimed in claim 2 in which the carriage is slidably mounted on a circular member affixed to a wheel coaxially therewith.
4. A wheelchair or a wheel as claimed in claim 3 in which the carriage is provided with a plurality of rollers adapted to bear against the annular member.
5. A wheelchair as claimed in claim 1 or a wheel, as claimed in claim 2 in which the handle includes a substantially cylindrical portion which may be gripped by a hand of the user, the cylindrical portion being so mounted on the carriage that it may be pivoted about an axis substantially normal to its own axis.
6. A wheelchair as claimed in claim 1 or a wheel as claimed in claim 2 in which the engagement means comprise a pad engageable with the annular member and manually operable actuating means on the handle adapted to cause the pad to be selectively brought into and out of engagement with the annular member.

7. A wheelchair or a wheel as claimed in claim 6 in which the handle is pivotably connected to the carriage and in which pivotal movement of the handle relative to the carriage causes the pad to be selectively brought into and out of engagement with the annular member.

8. A wheelchair as claimed in claim 1 or a wheel as claimed in claim 2 in which the carriage includes an elongate arm pivotably connected to the axle of the wheel to which it is affixed or to a member coaxial therewith.

9. A wheelchair or a wheel as claimed in claim 8 in which arm extends beyond the axle and is provided with a counterweight such that the handle carried by the carriage is biased into a position in which it may be readily grasped by a user of the wheelchair.

10. A wheelchair as claimed in claim 1 or a wheel as claimed in claim 2 in which the engagement means includes a pair of engagement pads each having a pair of converging substantially planar surfaces, which brake engagement pads are adapted to engage with a pair of annular surfaces which bound an annular groove in the annular member and which are each substantially planar in cross section and which, when seen in cross section, converge away from the engagement pads.

11. A wheelchair or a wheel as claimed in claim 10 in which the engagement pads are each connected to the handle through an engagement pad support member pivotably connected to the engagement pad and to the handle, these pivotal connections being about axes substantially radial to the annular member.

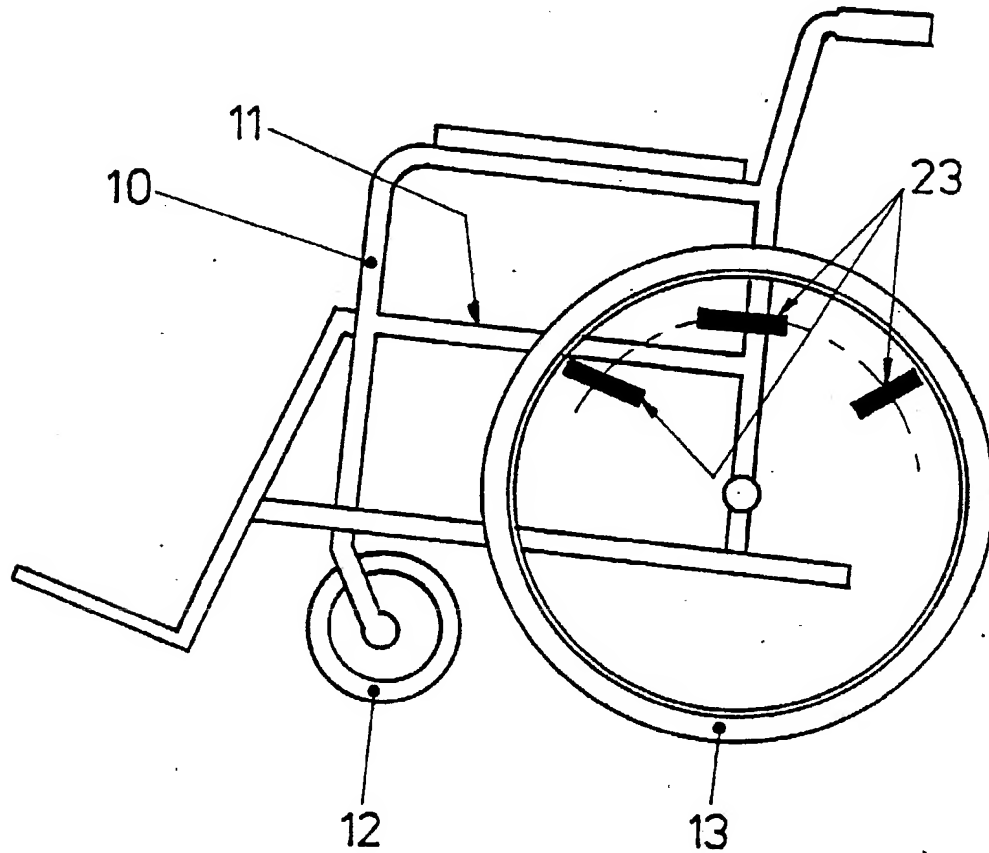


FIG. 1

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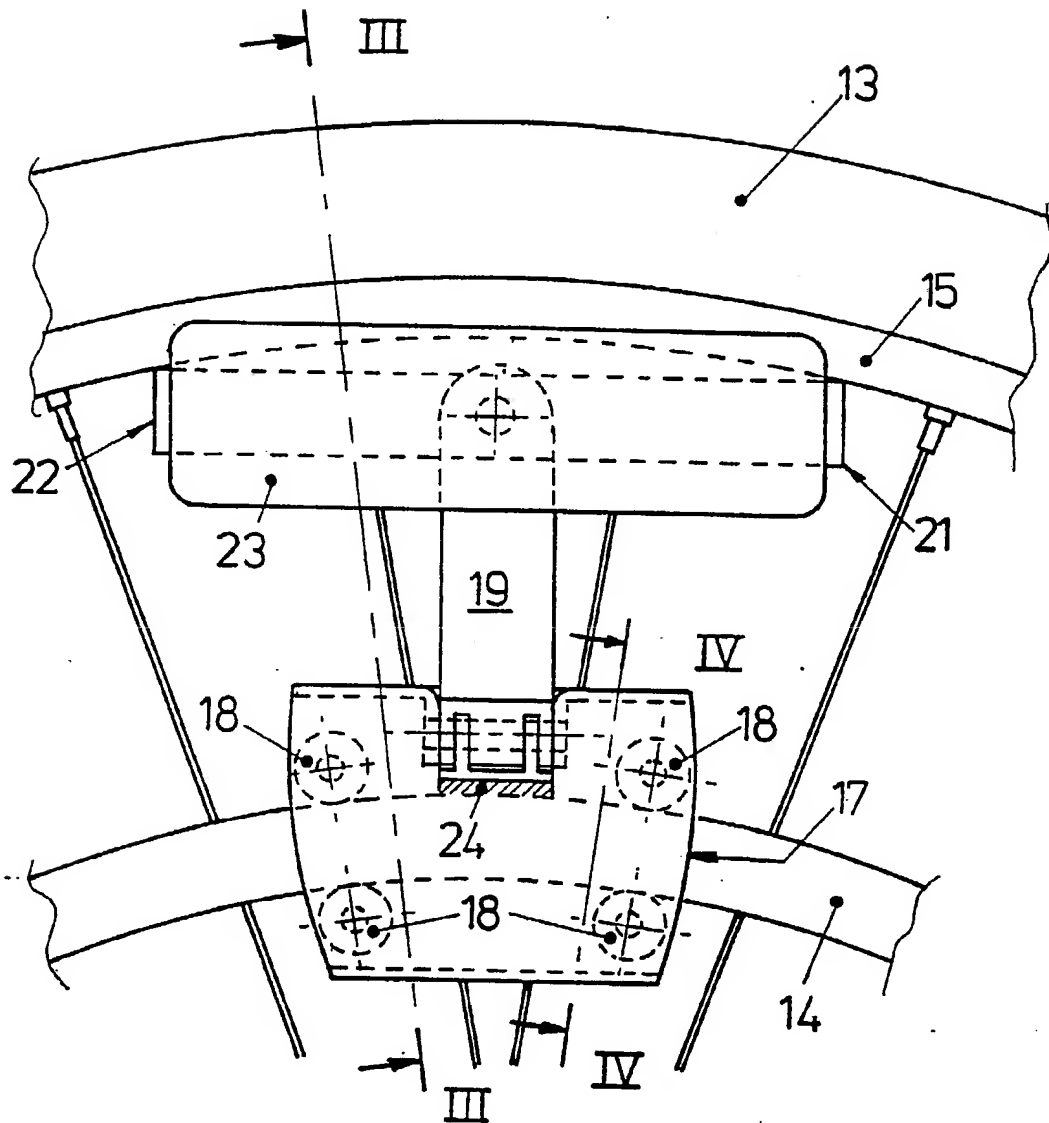


FIG. 2

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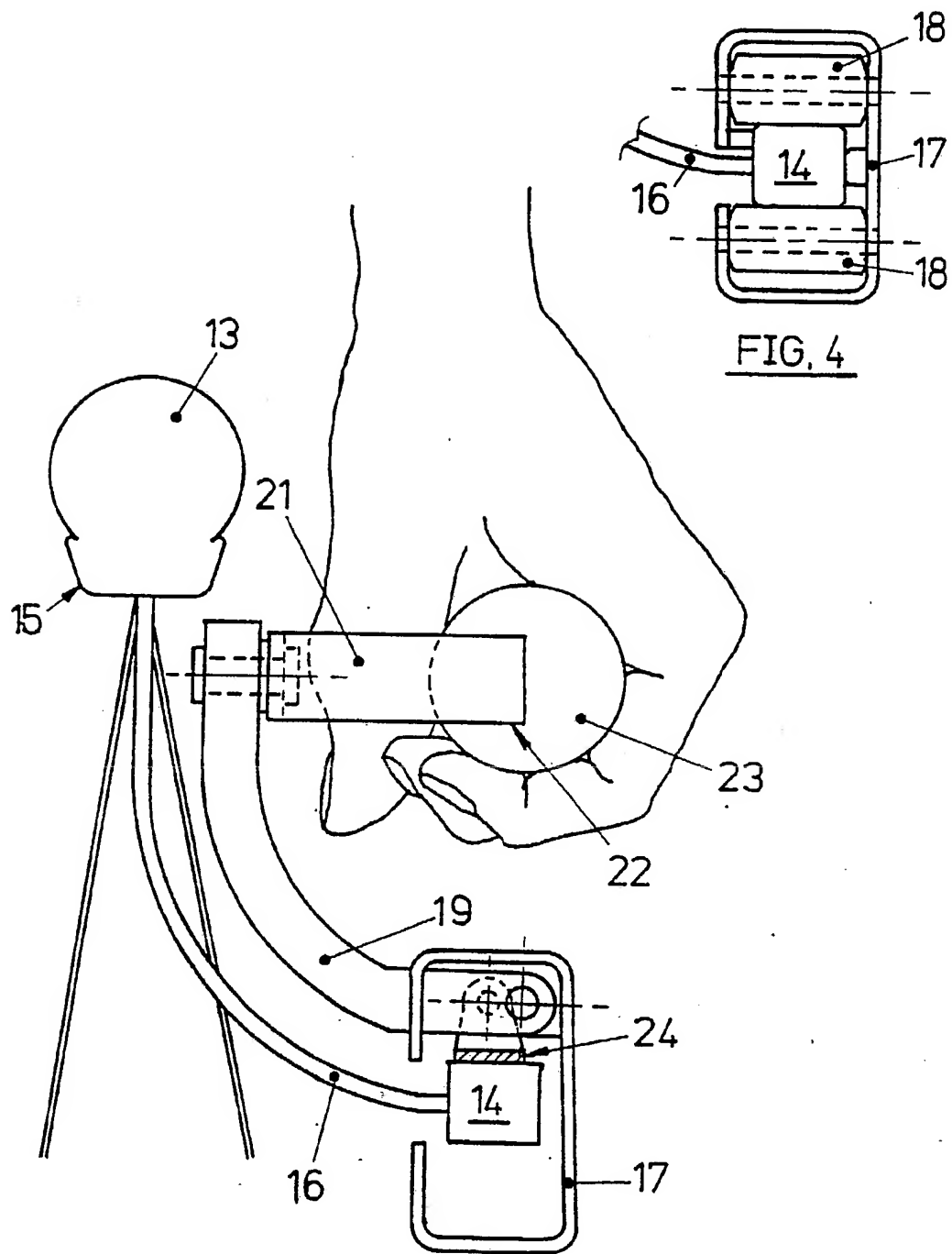


FIG. 3

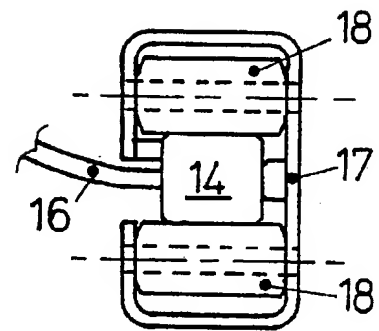
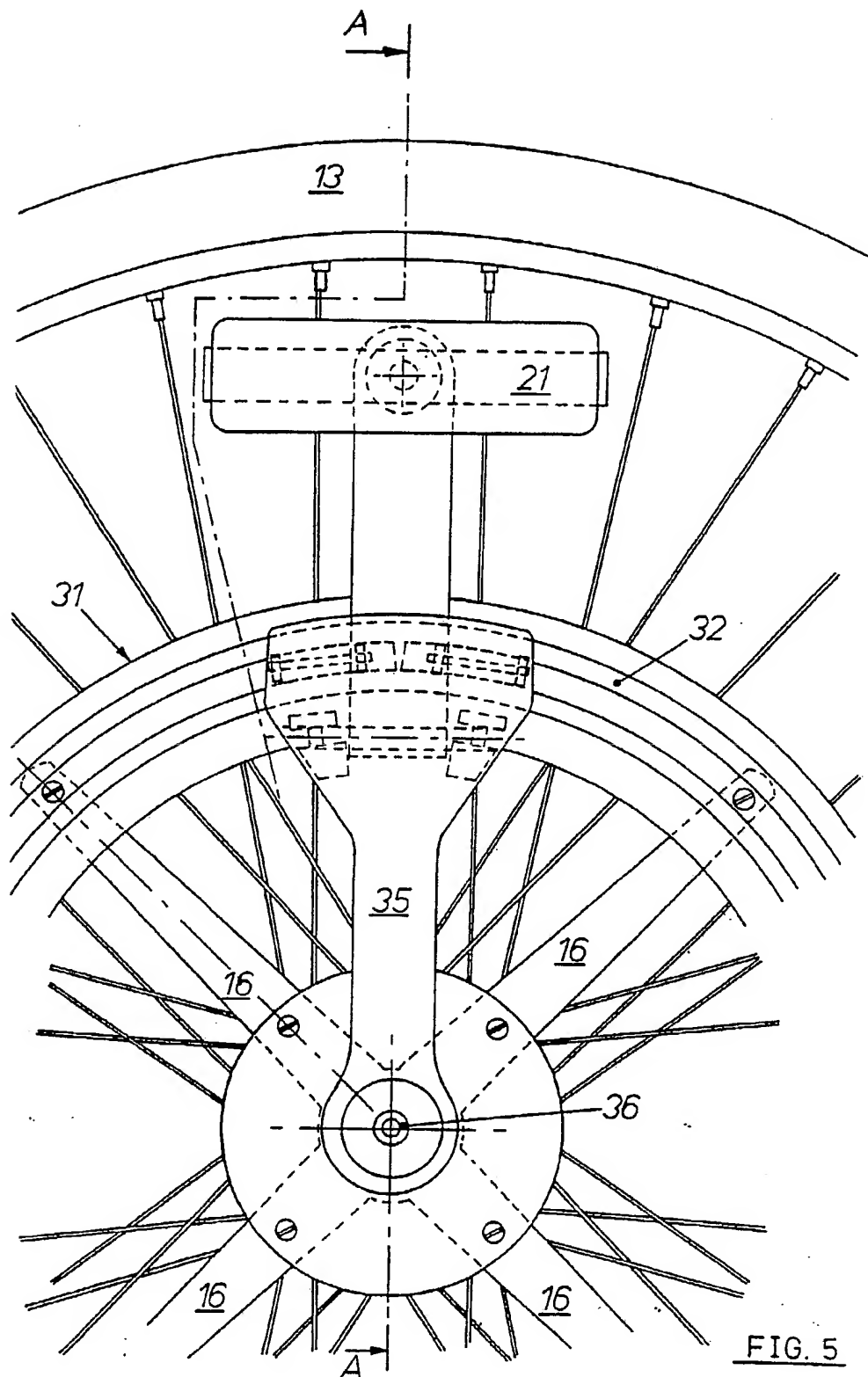
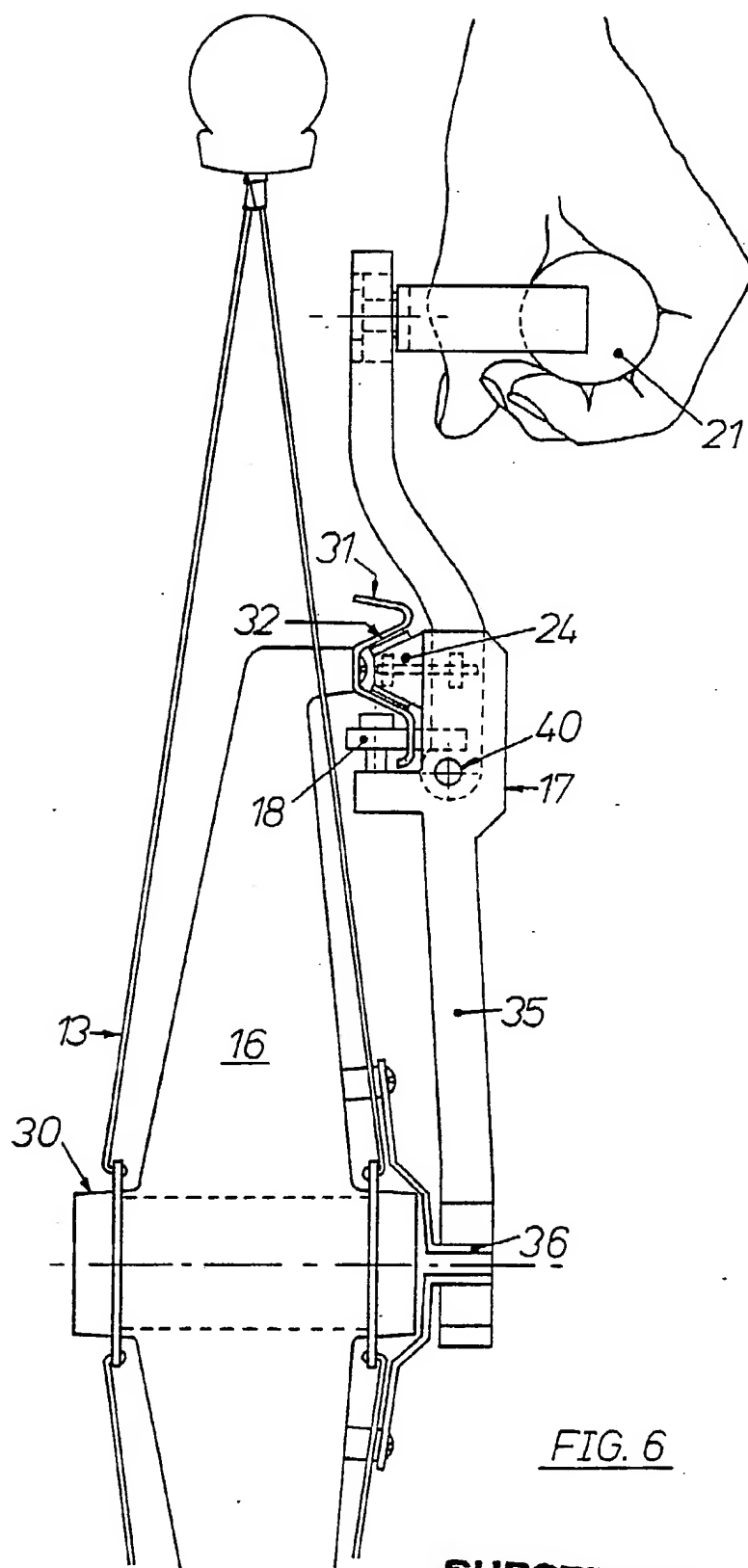


FIG. 4

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FIG. 6**SUBSTITUTE SHEET**

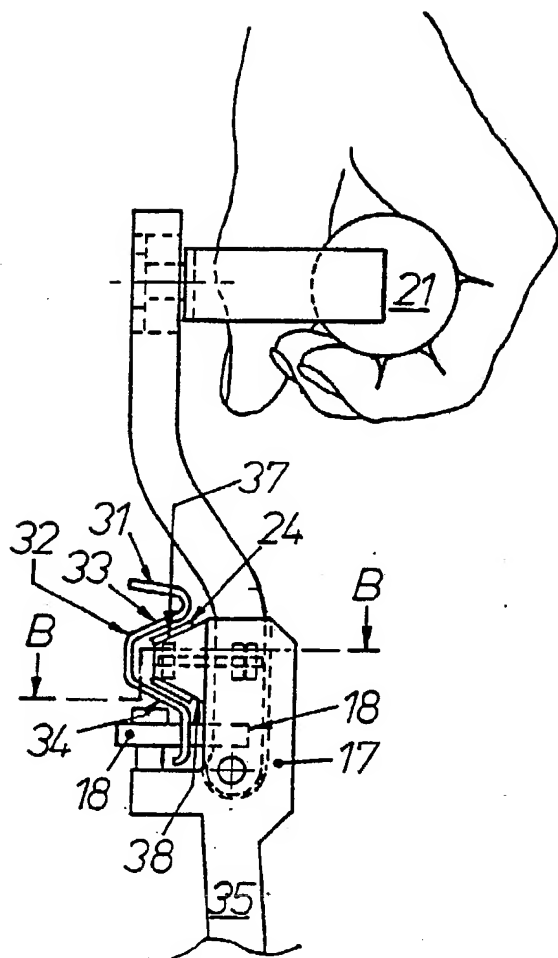


FIG. 7a

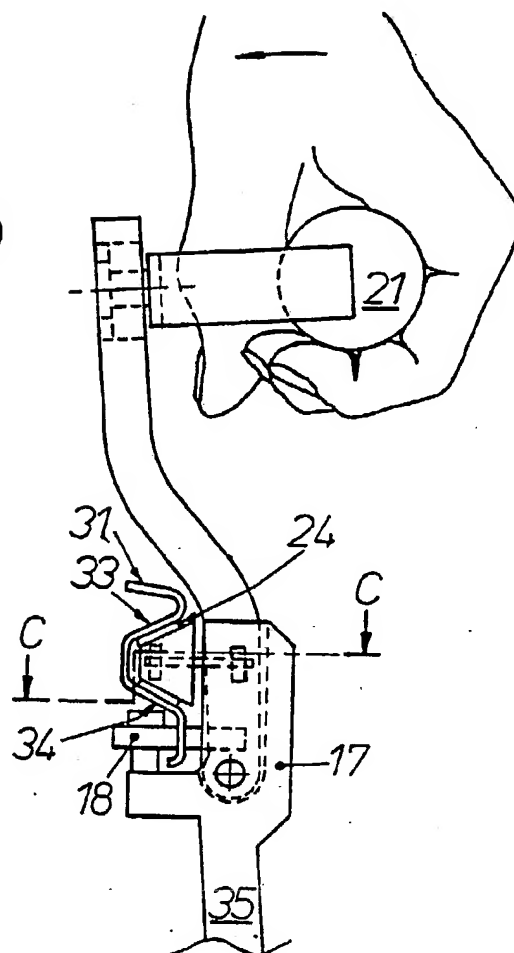


FIG. 7b

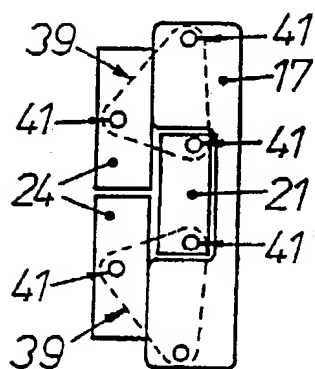


FIG. 8a

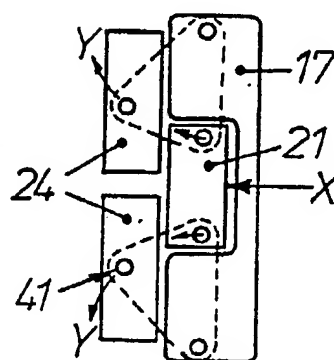


FIG. 8b

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# INTERNATIONAL SEARCH REPORT

International Application No. PCT/AU 89/00556

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) 6				
According to International Patent Classification (IPC) or to both National Classification and IPC				
Int. Cl. <sup>5</sup> A61G 5/02, B62M 1/14				
<b>II. FIELDS SEARCHED</b>				
Minimum Documentation Searched 7				
Classification System	Classification Symbols			
IPC	A61G 5/02, B62M 1/14			
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched 8				
AU : IPC as above				
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> 9				
Category*	Citation of Document, with indication, where appropriate, of the relevant passages 12	Relevant to Claim No 13		
X, Y	AU,A, 84386/82 (RUSSEL RICHARD FERRERS WAKELIN) 9 December 1982 (09.12.82)	1 - 8		
X, Y	AU,A, 29257/84 (PARAID LIMITED) 20 December 1984 (20.12.84)	1 - 8		
X, Y	US,A, 3189368 (PETERSEN) 15 June 1965 (15.06.65)	1 - 8		
X, Y	US,A, 3623748 (HAYNES) 30 November 1971 (30.11.71)	1 - 8		
X, Y	US,A, 3869146 (BULMER) 4 March 1975 (04.03.75)	1 - 8		
X, Y	US,A, 4354691 (SAUNDERS & LOWE) 19 October 1982 (19.10.82)	1 - 8		
(Continued)				
<p>* Special categories of cited documents: 10</p> <table style="width: 100%;"> <tr> <td style="width: 50%;"> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </td> <td style="width: 50%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"Z" document member of the same patent family</p> </td> </tr> </table>			<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"Z" document member of the same patent family</p>
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<b>IV. CERTIFICATION</b>				
Date of the Actual Completion of the International Search 22 March 1990 (22.03.90)	Date of Mailing of this International Search Report 17 April 1990			
International Searching Authority Australian Patent Office	Signature of Authorized Officer <i>Peter T West</i> PETER T WEST			

Form PCT/ISA/210 (second sheet) (January 1985)

## FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

X, Y	US,A, 4682784 (ANDERSON) 28 July 1987 (28.07.87)	1 - 8
X, Y	DE, 3610055 (AGOT) 1 October 1987 (01.10.87)	1 - 8
Y	US,A, 3309110 (BULMER) 14 March 1967 (14.03.67)	4
Y	US,A, 4652026 (BYRGE) 24 March 1987 (24.03.87)	4

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE 1

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claim numbers ..., because they relate to subject matter not required to be searched by this Authority, namely:
  
2. ☐ Claim numbers ..., because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3. ☐ Claim numbers ..., because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4 (a):

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING 2

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.
2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:
  
3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:
  
4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

## Remark on Protest

- ☐ The additional search fees were accompanied by applicant's protest.  
☐ No protest accompanied the payment of additional search fees.

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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON  
INTERNATIONAL APPLICATION NO. PCT/AU 89/00556

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Members			
DE	3610055				
US	4354691	CA	1152423		
AU	84386/82	BR	8203283	EP	67035
		ZA	8203920		JP 58004559
AU	29257/84	EP	129426	EP	129426
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END OF ANNEX